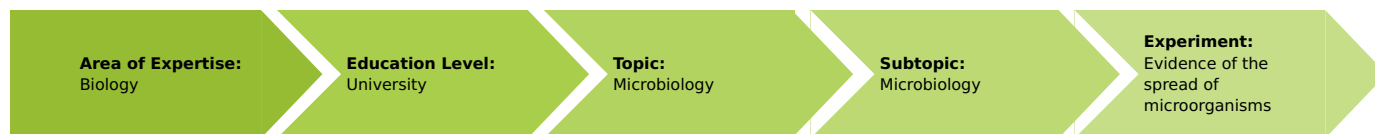


Evidence of the spread of microorganisms (Item No.: P4140200)

Curricular Relevance



Difficulty



Difficult

Preparation Time



30 Minutes

Execution Time



2 Hours

Recommended Group Size



2 Students

Additional Requirements:

- Diverse objects
- Insects

Experiment Variations:

Keywords:

Disinfection, Sterility, Nutrient agar

Overview

Short description

Principle

Microorganisms are ubiquitous, i.e. they are present everywhere around us. This fact can be proved by touching the objects that are to be examined in view of the presence of microorganisms against the sterile nutrient medium in a Petri dish and by incubating the plates afterwards. The easy working methods that are to be applied for this purpose are described based on the following examples. Evidence concerning the presence of microorganisms in soil and water can be provided most easily with the aid of the methods that are described afterwards. They also enable a quantitative analysis.

Equipment

Position No.	Material	Order No.	Quantity
1	Glass beaker DURAN®, tall, 600 ml	36006-00	1
2	Tripod, ring d=140 mm, h=240 mm	33302-00	1
3	Tweezers, l = 130 mm, straight, blunt	64610-00	1
4	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
5	Universal oven, 32 liters, 230 V	49559-93	1
6	Safety gas tubing, DVGW, sold by metre	39281-10	1
7	Bunsen burner, natural gas, w.cock	32167-05	1
8	Petri dish, d 100 mm	64705-00	10
9	Compact Balance, OHAUS TA 302, 300 g / 0.01 g	49241-93	1
10	Graduated cylinder 100 ml	36629-00	1
11	Microscopic slides, 50 pcs	64691-00	1
12	Graduated pipette 10 ml	36600-00	1
13	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
14	Erlenmeyer flask, narrow neck, 500 ml	36121-00	2
15	Test tube, 160 x 16 mm, 100 pcs	37656-10	1
16	Meat extract 10 g	31521-03	1
17	Peptone, dry, from meat 50 g	31708-05	1
18	Spatula, double blade, 150 mm	33460-00	1
19	Glass rod, boro 3.3, l=300mm, d=7mm	40485-05	1
20	Sterile stoppers f. id 15mm, 250	39266-00	1
21	Sterile stoppers f. id 29mm, 100	39267-00	1
22	Pipettor	36592-00	1
23	Autoclave with insert	04431-93	1
24	Heating + cooking hotplate, 230V	04025-93	1
25	pH test sticks 6.5-10, 100 sticks	30301-04	1
26	Sodium hydroxide, pellets, 500 g	30157-50	1
27	Water, distilled 5 l	31246-81	1
28	Agar-agar, powdered 100 g	31083-10	1
29	Ethyl alcohol, absolute 500 ml	30008-50	1

Tasks

1. Provide evidence concerning the presence of microorganisms in the air.
2. Provide evidence concerning the presence of microorganisms on objects of daily use.
3. Provide evidence concerning the presence of microorganisms on the skin.
4. Provide evidence concerning the presence of microorganisms on insects.

Set-up and procedure

Procedure

Evidence of the presence of microorganisms in the air

Evidence of the presence of microorganisms in the air that surrounds us can be provided by exposing sterile nutrient media in Petri dishes to an infection with microorganisms from the air and by incubating the plates afterwards. This method is particularly suitable for comparing the concentration of microorganisms in the air in different places, e.g. in the classroom, in a room that is only seldom used, next to a road with a lot of traffic, in a crowded leisure area, on a calm forest track, etc.

Pour plates with standard nutrient agar for bacteria. After the solidification of the nutrient medium in the plates, place the open plates for approximately 30 minutes in the places to be examined in order to expose the nutrient agar to microorganisms that fall down from the air. During this time, the covers of the plates are placed in a slanted manner on the rim of their respective lower parts. Position at least two plates in every place that is to be examined in order to ascertain the results for the comparison of examinations of different places. After the intended time, close the dishes and incubate them at 30 °C in an incubator. For every series of experiments, one additional plate whose nutrient agar had not been exposed to microorganisms in the air must also be incubated in order to verify the sterility of the nutrient medium prior to the start of the experiment.

Evidence of the presence of microorganisms on objects of daily use

Evidence concerning the presence of the microorganisms on objects of daily use can be provided by touching the sterile nutrient medium in Petri dishes against the objects and by incubating the plates afterwards. Interesting objects for examination are, for example, coins, bank notes, unused towels (especially towels that are to be used by numerous people), various parts of the handset of a telephone, and door handles.

Pour plates with standard nutrient agar for bacteria (see P4140100). After the solidification of the nutrient medium in the dishes, touch its surface slightly against the object to be examined (Fig. 1). In order to avoid an infection with microorganisms from the air when opening the dish, hold the cover of the plate so that it covers the lower part of the dish as completely as possible. Ensure that the inside of the plate and the nutrient agar come into contact only with the object to be examined and not with your fingers. Hold small objects, e.g. coins, with a pair of tweezers, but you must sterilise the tweezers beforehand. Close the plates and incubate them at 30 °C in the incubator. In order to verify the sterility of the nutrient medium prior to the experiment, incubate an additional, unused plate with the same nutrient agar for every series of experiments.

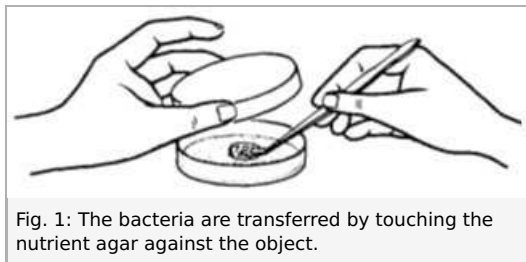


Fig. 1: The bacteria are transferred by touching the nutrient agar against the object.

Evidence of the presence of microorganisms on human skin

Evidence of the presence of microorganisms on human skin can be provided by touching the sterile nutrient media in Petri dishes with the tips of one's fingers and by incubating the plates afterwards. For comparison, the effectiveness of hygienic measures, e.g. washing one's hands, can also be demonstrated.

Pour plates with standard nutrient agar for bacteria (see P4140100). After the solidification of the nutrient medium in the dishes, touch it slightly with several fingertips. Lift the cover of the plates only as much as absolutely necessary and hold it so that it covers the nutrient medium as completely as possible in order to prevent it from being contaminated with microorganisms from the air (Fig. 2).

Close the plate and incubate it at 30 °C in the incubator. In order to verify the sterility of the nutrient medium prior to the experiment, incubate an additional, unused plate with the same nutrient agar.

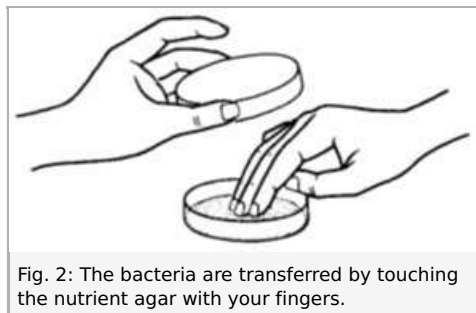


Fig. 2: The bacteria are transferred by touching the nutrient agar with your fingers.

Evidence of the transfer of microorganisms by insects

Evidence concerning the transfer of microorganisms by insects can be provided by bringing the sterile nutrient media in Petri dishes into contact with living insects and by incubating the plates afterwards.

Pour plates with standard nutrient agar for bacteria (see P4140100). After the solidification of the nutrient medium, place a living insect, e.g. a housefly (*Musca domestica*) or blowfly (*Calliphora erythrocephala*) into the closed plate with a pair of tweezers (Fig. 3). Ensure that any other infection of the nutrient medium except for by the insect is made impossible. After 5 minutes, let the insect escape by briefly lifting the cover. Then, incubate the plate at 30 °C in the incubator. In order to verify the sterility of the nutrient medium prior to the experiment, incubate an additional, unused plate.

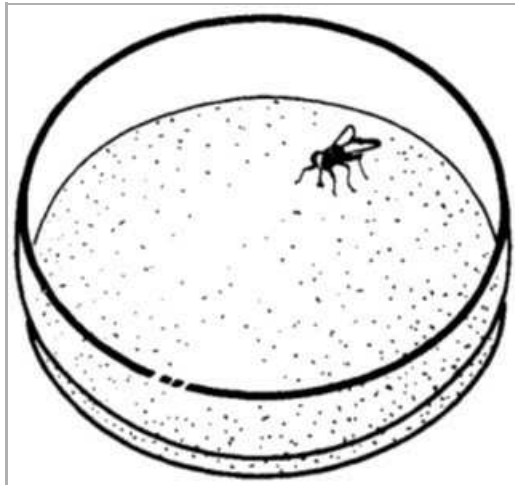


Fig. 3: A fly on nutrient agar.

Theory and evaluation

Results

Task 1: Evidence of the presence of bacteria in the air

Within two to three days, colonies of various types of microorganisms develop on the nutrient media that had been exposed to the air. Their nature, i.e. their size, colour, shape, surface structure, limitation, etc. can vary to a high extent. Under otherwise identical experiment conditions, the number of colonies depends on the concentration of microorganisms in the air at the sampling location.

Perform a microscopic examination of the colonies as described in P4140300.

The nutrient agar of the control plate that had not been exposed to microorganisms in the air should not show any microbial development.

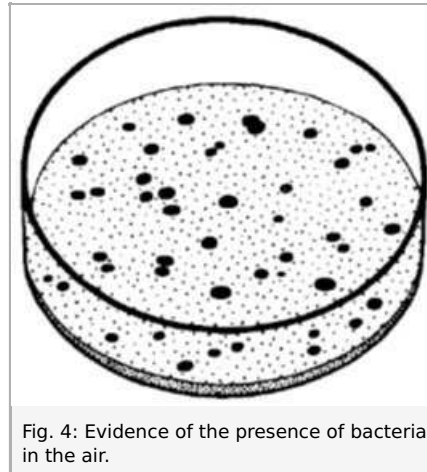


Fig. 4: Evidence of the presence of bacteria in the air.

Task 2: Evidence of the presence of microorganisms on objects of daily use

Within two to three days, colonies of microorganisms develop on the nutrient media that had contact with an object of daily use. These colonies may differ from each other, but it is also possible that all or nearly all of them look identical. Their number usually varies greatly in the case of comparative examinations of various objects. If the size of the contact surface is taken into consideration, it can provide an indication concerning the concentration of microorganisms on the surface of the examined object.

Perform a microscopic examination of the colonies as described in P4140300.

The nutrient agar of the unused control plate should not show any microbial development.

Task 3: Evidence of the presence of microorganisms on the skin

Within two to three days, bacterial and/or fungal colonies develop on the nutrient media that had been touched with the fingertips. The number of colonies depends on the microbial concentration on the skin. If an experiment is performed before and also after the test person has washed their hands, the results should show clear differences.

Perform a microscopic examination of the colonies as described in P4140300.

The nutrient agar of the unused control plate should not show any microbial development.

Task 4: Evidence of the presence of bacteria on insects

Within two to three days, microbial colonies develop on the nutrient medium that had been in contact with the insect. Perform a microscopic examination of the colonies as described in P4140300.

The nutrient agar of the unused control plate should not show any microbial development.